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1. Objectives

The aim of this study is to provide an overview of the existing information flow and information exchange processes employed between stakeholders in the D2D maritime sector and the likely future trends as a result of the requirement for more efficient information management and increased integration and interoperability between information systems being promoted by EU policies and legislation.

2. Background

In recent years, the amount of information becoming available in the maritime sector has increased rapidly as has the need to transfer information between stakeholders and the associated increasing accuracy requirements. Large amounts of information are generated and stored by the various maritime stakeholders; however, this information is not always complete, relevant or in the required format for all stakeholders.

Because of the increasing requirement for information and its rapid transfer between stakeholders, there is also a need to convert completely from the use of paper documentation to electronic document and messaging and while this has already been achieved in some quarters, there is some way to go. The PROPS (Promotional Platform for Short Sea Shipping and Intermodality) project, which is supported by the EC, carried out a survey amongst major stakeholders in the European D2D logistic chains during 2008 and found that E-mail was the most commonly used tool for communication between different actors in the logistics chain. Phone and fax were also used. Stakeholders, in general, acknowledged the need for improved availability, accurate and faster flow of information, good track and trace facilities and improvements in customs procedures. The challenges to future information flow are also discussed in the survey.

The flow of electronic information between the shipping companies and other various maritime stakeholders has been limited in the past because of the incompatibility of their IT systems to communicate efficiently with each other because each stakeholder has its own dedicated IT network. Stakeholders, including providers of logistics services, have been using their own “closed systems”, that is, procedures and systems

that are used inside one organisation or a cluster of organisations, with limited possibilities to interact with other systems.

Examples of the current types of problems which may arise in the electronic transfer of information flow include the fact that the information may not be in computer format (paper format, email format), may be in the wrong electronic format (UN/EDIFACT.XML etc), may not be accessible to particular Stakeholders or cannot be transferred between Stakeholders incompatible IT systems. Standardisation of administrative procedures, messages, and documentation relating to the carriage and transport of passengers and freight throughout the EU transport and logistics chain is required to improve efficiencies, to ensure competitiveness and to ensure the seamless integration at intermodal interfaces.

Website: www.props-sss.eu/

3. Approach

This study provides an overview of the information flow is in the maritime sector with specific reference to:

1. Existing information systems and likely future trends
2. Current state of use of electronic messaging and information exchange in maritime based D2D chains
3. Developments on standardised messages based on XML technology
4. Standardisation initiatives (IMO, ISO, etc)

Conclusions are drawn and recommendations made regarding information flow requirements and standardisation needs to meet future D2D transport networks needs.

4. Target Stakeholders

- Shippers
- Transport service providers
- Ports, their Authorities (safety and security related) and Community System operators
- Maritime Administrations
- Intermediaries and IT providers who are working together to develop XML based standards
- Policy makers interested in rationalisation or harmonisation of regulatory requirements and interactions between regulation enforcement authorities
- Authorities requiring pre-reporting from shipping
- SAR, OPRC and MAS services
- Ship Masters

5. Glossary of terms

AIAG	Automotive Industry Action Group
AIS	Automatic Identification System
B2B	Business-to-Business
CCS	Cargo Control System
D2D	Door-to-Door
eBusiness	The utilization of ICT in support of all the activities of business.
eGovernment	The use of ICT to provide and improve government services, transactions and interactions with citizens, businesses, and other arms of government.
ebXML	Electronic Business using eXtensible Markup Language
EC	European Commission
EDI	Electronic Data Interchange

EDIFACT	Electronic Data Interchange For Administration, Commerce and Transport
EDIFICE	The European B2B User Group for companies with interests in computing, electronics and telecommunications,
EIS	European Index Server
EMSA	European Maritime Safety Agency
EU	European Union
FAL	Facilitation Committee (of IMO)
GDTI	Global Document Type Identifier
GDSN	Global Data Standards Network
GIAI	Global Individual Asset Identification
GINC	Global Identification Number for Consignment
GLN	Global Location Number
GSID	Global Shipment Identification Number
GTN	Global Trade Number
HAZMAT	Hazardous Materials
HF	High Frequency
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IEDI	Interative Electronic Data Interchange
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
ISPS	International Ship and Port Security
IT	Information Technology
ITIGG	International Transport Implementation Guidelines Group
ITU	International Telecommunications Union
LCA	Local Competent Authority
LIM	Logistics Interoperability Model
LRIT	Long Range Identification System
MAS	Maritime Assistance Services
MRCC	Maritime Rescue Coordination Centre
NCA	National Competent Authority
NGO	Non Government Organisation

OASIS	Organization for the Advancement of Structured Information Standards
ODETTE	Organisation for Data Exchange by Tele Transmission in Europe
PCS	Port Community System
RFID	Radio Fequency Identification
RIS	River Information Services
SAR	Synthetic Aperture Radar
SOLAS	Safety of Life at Sea
SSCC	Serial Shipping Container Code
STIRES	SafeSeaNet Information, Relay and Exchange System
STMID	Shore based Traffic Monitoring Infrastructure Database.
SSN	SafeSeaNet
SSS	ShortSeaServices
TDED	Trade Data Elements Directory
UHF	Ultra High Frequency
UN	United Nations
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UN/ECE	United Nations Economic Commission for Europe
UN/EDIFACT	United Nations/Electronic Data Interchange For Administration, Commerce and Transport
UNTID	United Nations Data Interchange Directory
VHF	Very High Frequency
VTS	Vessel Traffic Services
VTIMS	Vessel Traffic Information Management System
WC3	World Wide Web Consortium
WCO	World Customs Organisation
XML	Extensible Markup Language

6. Information Flow in the Maritime Transport Sector

6.1 Background

The rapid evolvement of Information and Communications Technologies (ICT) is enabling the processing and the rapid transfer of large amounts of data between stakeholders. Communication systems available-to and used-by the maritime and transport industries cover the spectrum of terrestrial (land lines, fibreoptics, telephone, HF/VHF/ UHF radio) and satellite communication systems; the availability of these has enabled the use of the internet and the possibility of real time information flow.

The communication infrastructure currently available in the maritime sector has also enabled shipping companies to integrate their ships within their own overall IT networks. However, the flow of information between the shipping companies and other various maritime stakeholders has been limited in the past because of the incompatibility of their IT systems to communicate efficiently with each other because each stakeholder has its own dedicated IT network.

The EU Transport Policy promotes the development of sustainable, innovative, intermodal and interoperable regional and national transport and logistics networks, infrastructures and systems in Europe. Within a D2D intermodal transport network there is a need to communicate information between the many more different transport stakeholders involved and with all the stakeholders involved in providing the transport infrastructure and other authorities. The efficient, rapid and error free transfer of information between stakeholders necessitates the use of standardised electronic processes between the stakeholders.

The European Union's Transport Logistics Action Plan[1] proposes a Single European Transport Document to streamline cargo and traffic information exchange between authorities and between authorities and other stakeholders. There is also a need to

[1]A transport document is required today to follow the carriage of goods (Reg. 11/60 and Directive 92/106/EC); According to the Freight Transport Logistics Action Plan, a Single European Transport Document will be established that can be used in all transport modes enhancing the framework offered by multimodal waybills or multimodal manifests

convert completely from the use of paper documentation to electronic messaging; this is being achieved in some quarters. Examples of these are the following two EU initiatives:

"e-Freight"- action of the EU Freight Logistics Action Plan which denotes the vision of a paper-free, electronic flow of information associating the physical flow of goods with a paperless trail built by ICT across different transport modes

e-Customs - aimed at providing a paperless environment for customs and trade by making Member States' electronic customs systems compatible with each other and creating a single, shared computer portal.

Both the above are linked to the EU e-Maritime initiative aimed at supporting the development of European capabilities, strategies and policies facilitating the adoption of upgraded "e-Maritime" solutions in support of an efficient and sustainable waterborne transport system fully integrated in the overall European transport system.

The current electronic mechanisms used to interact have been the use of electronic messaging based on EDIFACT (Section 5) inspired philosophies although the use of other mechanisms such as XML technologies are being investigated in a number of projects and is used in the Safe Sea Net (SSN) platform.

6.2 Development of Maritime Sector Information Systems

In recent years, a number of information management systems have been developed or are under development in the maritime sector which satisfy the needs of small clusters of stakeholders. These tend to be autonomous and are not always capable of communicating and inter-acting with each other and hence the efficiency of information transfer between stakeholder clusters is limited. Interoperability is restricted. A requirement therefore exists for improved information management across the maritime sector and this is now being addressed and promoted under the European Maritime Transport Strategy.

There are EU Initiatives such as SafeSeaNet (SSN), e-Navigation and e-Maritime aimed at providing for the integration, simplification and interoperability of existing and future information systems, These aspects will have significant implications on information flow in future D2D transport and logistics systems; some of the more important are described in the following sections.

Cargo Community System (CCS) – defined as a community system that, based on *an integrated series of procedures, rules, standards, and ICT tools, supports the automatic exchange of data, information and documents related to the handling, storage and transport of cargo.* Developed to handle the exchange of information related to cargo and cargo clearance, it dealt with the exchange of cargo related information and mainly with the acceptance, handling and storage of containers on the terminals with the aim of decreasing the enormous amount of paper and other information exchanges necessary to handle and store the millions of containers. These information systems were developed by terminals and cargo carriers without much input from Port Authorities. Subsequently, Port Authorities have taken the lead in the development of Port Community Systems[2].

Port Community System (PCS) - A PCS is defined as a community system which based on *an integrated series of procedures, rules, standards and ICT solutions supports the automatic exchange of data and documents related to the port authorities' clearance of ships and cargo upon arrival, stay and departure of vessels*. In quite a number of ports worldwide, the Port Authorities have taken the lead in developing Port Community Systems. A PCS primarily supports the requirements of governmental agencies, but also the requirements of the cargo interests. A PCS covers Customs requirements and handling, Immigration as well as the information exchange dealing with the necessary services in a port and the handling of ship and cargo. Good examples of PCSs can be found in Singapore, Barcelona, Le Havre, Genoa, Southampton, and Cape Town[2].

River Information Services (RIS) – In the inland navigation sector, the deployment of a RIS platform at EU level is well advanced. The River Information Services (RIS) provide harmonised information services to support traffic and transport management in inland navigation, including interfaces to other transport modes and is progressing under a master plan agreement. RIS do not deal with internal commercial activities between one or more of the involved companies, but are open for interfacing with commercial activities. RIS comprise services such as fairway information, traffic in-

[2] MarNIs Deliverable D1.3.G, Information Services in Ports, 27-06-2006

formation, traffic management, calamity abatement support, information for transport management, statistics and customs services and waterway charges and port dues.

Vessel Traffic Management and Information Systems - Directive 2002/59/EC of the European Parliament and Council of 27 June 2002 aims at establishing a *vessel traffic monitoring and information system* "with a view to enhancing the safety and efficiency of maritime traffic, improving the response of authorities to incidents, accidents or potentially dangerous situations at sea, including search and rescue operations and contributing to a better prevention and detection of pollution by ships".

A vessel traffic management and information system is essentially a data gathering, handling and management system that collects, evaluates and disseminates selected data. The information is utilised to provide a range of services such as:

Information Service - to ensure that essential information concerning the area, the governing circumstances and the traffic situation is, in time, available to the shipboard navigational decision making process

Navigational Assistance Service - to contribute or participate in the navigational decision making process on board and to monitor the effects. The extent to which navigational assistance can, and may, be given from the shore depends to a large degree upon national legislation and the qualifications of the VTS operator.

Traffic organisation service - to provide for the safe and efficient movement of traffic and to prevent the development of dangerous situations within the VTS area by the forward planning and monitoring of movements.

Co-operation with allied services and adjacent VTS - to integrate the effects of VTS and to coordinate the information flows for the collection, evaluation and dissemination of data.

Automatic Identification Systems (AIS) and Long Range identification Systems (LRIT) – these systems, which are now becoming operational, provide additional in-

formation regarding maritime vessels which can also be used for enhancing the efficiency of D2D transport systems. Such information is used to enable the safe, efficient control and monitoring of vessels.

The IMO consider that it would be appropriate to standardize the format for ship reporting systems and agreed, in principle, with the proposed Extensible Markup Language (XML) format standards for maritime services. It was felt that direct data exchange between ship to shore, but also between vessel traffic services (VTS) and others (authorities, shipowners and shipping agencies), by XML format (described in Section 5), would contribute to improved safety and security.

Website: www.imo.org

SafeSeaNet:

The European Commission, in response to its maritime safety legislation (Directive 2002/59) launched the development of a SafeSeaNet (SSN) to provide a European Platform for Maritime Data Exchange between the EU maritime Administrations promoting co-operation in preventing maritime pollution and accidents at sea. SafeSeaNet includes the EIS (European Index Server) operated by the European Maritime Safety Agency (EMSA) which provides a "hub and spoke" network (including authentication, validation, data transformation, and logging) for sending requests to and receive notifications and responses from users.

Each member state is responsible for implementing a SSN national application. The current deployment of SafeSeaNet involves the following entities at national and regional local level:

- *National Competent Authority* (NCA) – body that assumes on behalf of the Member State the responsibility of SafeSeaNet management. It is in charge of verification and maintenance of the national network and procedures complying with the requirements as described within the SSN Interface Control Document;
- *Local Competent Authority* (LCA) - the authorities or organisations designated by Member States to receive and transmit information pursuant to Directive 2002/59/EC e.g. Port authorities, Coastal Stations, Vessel Traffic Service, shore-based installations responsible for a mandatory reporting system approved by the IMO, or bodies responsible for co-ordinating search and rescue operations.

According to Directive 2002/59 Member States are required to complete their SafeSeaNet (SSN) national systems and interlink them for exchanging the four basic messages (port, HAZMAT, ship and alert notifications) by the end of 2008. The implementation of SSN began in 2002 and the technical specifications remain unchanged to give the necessary time to all Member States to comply with the requirements of the first SSN version.

EMSA deployed in January 2008, Version 1.9 of SSN to improve the system performance, scalability, robustness and software maintainability. With SSN V 1.9 all national applications are in "production". Additional SSN elements are the EU AIS database and STMID - Shore based Traffic Monitoring Infrastructure Database.

Among the major milestones for implementation in 2009 is the STIRES (SafeSeaNet Information, Relay and Exchange System) to transform SSN into a tracking system extending its usability for the Member States not only as an emergency tool, but also as a system assisting in routine daily operations. The data originated by the on board AIS is picked up by the MS shore based AIS network and is relayed to the regional or EU network, at a sampled rate, without any delay.
SSN utilises new technologies such as XML.
The management and future evolution of this system is carried out by the Commission, assisted by the SafeSeaNet High Level Steering Group,as defined by Directive 2002/59/EC.

SafeSeaNet Website: http://extranet.emsa.europa.eu

e-Navigation - This is an International Maritime Organisation (IMO) led concept which is intended to meet present and future user needs and is based on the harmonisation of marine navigation systems and supporting shore services driven by user needs. e-Navigation encompasses human factors, standards, procedures etc and is more than a system comprising of integrated subsystems and equipments. E-navigation is *'the collection, integration and display of maritime information aboard and ashore by electronic means to enhance berth-to-berth navigation and related services, safety and security at sea, and the protection of the marine environment'*

e-Maritime - The objective of the European e-Maritime initiative is to promote "coherent, transparent, efficient and simplified solutions in support of cooperation, interoperability and consistency between member States, sectors, business and systems involved in the European Transport System. The e-Maritime Initiative includes facilitating the take-up of the latest enabling ICT technologies and the development of internet based interactions between the various information systems and stakeholders to improve the interoperability, sustainability of maritime transport and to improve its integration into the overall EU transport system.

In support of this, new standards and regulations need to be put in place and/or existing standards improved which govern information gathering, storage and exchange between stakeholders. Currently there are national and international standards coexisting which cover similar aspects and sometimes overlap and have inconsistencies between them because of the timescales and ways in which they have been developed.

Single Window Concept - A Single Window environment is defined (UN ECE Recommendation 33, Recommendations and Guidelines on Establishing a Single Window) as an intelligent facility which allows the stakeholders involved in trade and transport to lodge standardized information, mainly electronic, with a single entry point to fulfill all import, export and transit related regulatory requirements. The implementation of a single window requires standardisaton and harmonization of information and, in particular, data. The benefits provided by the Single Window include reduction in cost simplification of procedures, reduced reporting burden avoiding duplication, and improved accuracy. The Single Window approach has been in use since the early 2000s and is being promoted by the European Union and for maritime related industries by the IMO.

Port Community Systems, such as those in operation in Finland, France, Norway and Spain, incorporate a single window environment which cater for aspects such as customs procedures and documentation, import/export procedures, port related procedures for stakeholders involved in port operations and trade including the relevant authorities.

There is also an e-Customs Single Window project which is aimed at producing functional specifications in 2011. The objective of the Single Window will be to enable economic operators to electronically lodge all the information required by customs and non-customs legislation for EU cross-border movements of goods once only.

Both the EU's e-Navigation and e-Maritime initiatives promote the concept of a single window approach to achieve their goal.

7. State of the Electronic Information Exchange

7.1 Overview

The evolvement in information processing and information transfer for e-commerce purposes since the late 1960s has resulted in the development and establishment of business-to–business information transfer methods and standards in several business sectors. These processes and associated standards are briefly described in the following sections; some of these are applicable to the transport and maritime industries.

7.2 Electronic Data Interchange (EDI)

Electronic Data Interchange is an electronic message transfer format that enables the exchange and transfer of information between organizations/computers. EDI has been around since the late 1960s and is essentially independent of the communication protocols and transmission media although it has benefited from the availability of the internet. Documents prepared using software packages such as Microsoft or Sage need formatting or mapping into an EDI format before transfer to another organisation's computer. Over the years, many different standards of EDI format have been developed and are in use globally. Essentially, EDI standards allow for open systems, provide for third party interfaces, and define aspects such as rules of editing and syntax, data organization,

Different global regions and sectors of industry have developed their own versions. Some of these industry groups are working together to share their standards for example, the European High Tech Electronic Industries are working with the European Automotive Industry (increasing amounts of electronics is being adopted by the automotive industry). Many of the industry sectors mentioned above trade worldwide; this is

resulting in suppliers in India and China, for example, adopting EDI for conducting their business transactions.

Examples of forms of EDI are:

- **ODETTE**

  ODETTE is developed by the Organisation for Data Exchange by Tele Transmission in Europe, a group that represents the interests of the automotive industry in Europe; equivalent of the Automotive Industry Action Group (AIAG) in North America.

  Website: www.odette.org

- **EDIFICE**
- EDIFICE is developed by the European hi-tech industries**.** The group represents the majority of the European Electronics Industry including companies with interests in computing, electronics, and telecommunications. This Group is working closely with the aerospace industry to standardise their approach to EDI.

  Website: www.edifice.org

- **United Nations/Electronic Data Interchange For Administration, Commerce and Transport (UN/EDIFACT)**

  This is the international EDI standard developed under the United Nations. The work of maintenance and further development of this standard is done through the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). EDIFACT has been adopted by the International Standards Organisation as the ISO standard ISO 9735.

  At its meeting 1990-03, Working Party 4 agreed on the following definition of UN/EDIFACT:

  - They comprise a set of internationally agreed standards, directories and guidelines for the electronic interchange of structured data, and in particular that related to trade in goods and services between independent, computerized information systems.

- Recommended within the framework of the United Nations, the rules are approved and published by UN/ECE in the United Nations Trade Data Interchange Directory (UNTDID) and are maintained under agreed procedures.

The EDIFACT standard provides

- a set of syntax rules to structure data,
- an interactive exchange protocol (IEDI),
- standard messages which allow multicountry and multi-industry exchange.

Thus it is a standard for the data format, but not for the data transmission.

Website: www.unece.org/trade/untdid/welcome.htm

- **ROSETTANET**

This is a non-profit consortium of major computer and consumer electronics, electronic components, semiconductor manufacturing, telecommunications and logistics companies working to create and implement industry-wide, open e-business process standards. The RosettaNet standard is based on XML and defines message guidelines, business processes interface and implementation frameworks for interactions between companies. Mostly addressed is the supply chain area, but also manufacturing, product and material data and service processes are within the scope.

The standard is widely spread in the global Semiconductor Industry, but also electronic components, consumer electronics, telecommunication and logistics. RosettaNet originated in the US and is widely used there, but it is also well accepted and even supported by governments in Asia. Due to the wide spread use of EDIFACT in Europe, RosettaNet is used less.

Website: www.rosettanet.org

- **Extensible Markup Language (XML)**

XML is a simple, very flexible text format originally designed for large-scale electronic publishing. It was developed by an XML Working Group under the auspices of the W3C (the World Wide Web Consortium).

The original design goals for XMl are:

- XML shall be straightforwardly usable over the Internet.
- XML shall support a wide variety of applications.
- XML shall be compatible with SGML.
- It shall be easy to write programs which process XML documents.
- The number of optional features in XML is to be kept to the absolute minimum, ideally zero.
- XML documents should be human-legible and reasonably clear.
- The XML design should be prepared quickly.
- The design of XML shall be formal and concise.
- XML documents shall be easy to create.
- Terseness in XML markup is of minimal importance

XML provides a means of structuring, storing, and transporting information and provides a standard open format and mechanisms for structuring a document so that it can be exchanged and manipulated. It provides a means for communities to develop structured mechanisms for marking text and data to facilitate the exchange and manipulation of documents among the community members. There are two relevant specifications[3] covering basic XML message handling which have been issued by the WC3 consortium and are available from the WC3 website.

The XML specifications, together with associated standards (Unicode and ISO/IEC 10646 for characters, Internet RFC 3066 for language identification tags, ISO 639 for language name codes, and ISO 3166 for country name codes), provide all the information necessary to understand XML Version 1.1 and construct computer programs to process it.
Many variations to the basic XML have been developed; those most relevant to the transport and maritime industries are briefly described in the following sections.
Website: www.w3.org

- **Electronic Business using eXtensible Markup Language - ebXML**
  This is a standard for an e-business framework that enables enterprises of any size, in any location to meet and conduct business electronically. Developed

[3] Extensible Markup Language (XML) 1.0 (Fifth Edition) November 2008
Extensible Markup Language (XML) 1.1 (Second Edition), September 2006

under the auspices of OASIS (Organisation for the Advancement of Structured Information Standards) and UN/CEFACT, Electronic Business using eXtensible Markup Language, ebXML, is a family of XML based standards sponsored by OASIS and UN/CEFACT whose mission is to provide an open, XML-based infrastructure that enables the global use of electronic business information in an interoperable, secure, and consistent manner by all trading partners.

Website: www.uncefact.org

- **EDIFACT/XML**

EDIFACT is likely to remain the most widely used form of EDI in high tech, civil aviation, retail and tourism industries, due to the amount of software that leverages the standard, and the need for integration between new systems and legacy systems.

An advantage of EDIFACT is the availability of agreed message-contents, which XML must leverage to develop its own similar agreed contents. An equivalent XML message has a larger file size than an EDIFACT message (EDIFACT-messages can be as much as one tenth the size of XML-messages) which makes XML less attractive for very high volume applications. However, more tools exist to work with XML data than with EDIFACT.

XML/EDIFACT is an Electronic Data Interchange format used in Business-to Business transactions. It allows EDIFACT message types to be used by XML based systems. EDIFACT is a formal language for machine readable description of electronic business documents. It uses a syntax close to delimiter separated files. This syntax was invented in the 1980s to keep files as small as possible. Because of the Internet boom around 2000, XML started to become the most widely supported file syntax. (Wikipedia)

EDIFACT works perfectly from the content viewpoint, but many software systems struggle to handle its syntax. Combining EDIFACT vocabulary and

grammar with XML syntax makes XML/EDIFACT. The rules for XML/EDIFACT are defined by ISO TS 20625.

7.3 Electronic Information Exchange in the Maritime Sector

7.3.1 Overview

EDI is now well established as a means of electronic information exchange between organizations for business-to business purposes. Intermodal D2D transport involves road/rail and maritime transport and whilst EDI is used in all three modes, there are differences and they are not yet compatible. Many companies have already made investments in EDI and it is therefore essential that as sector orientated messaging formats are developed that these are compatible with the existing EDI message formats.

When vessels enter or leave ports, they have to comply with the reporting requirements of the port authorities such as the formal and legal notifications required and also the requests for services from the port and vessel handling companies. Vessels also need to exchange information with their owners, operators, agents, freight forwarders etc. The IMO and EU have introduced legislation covering Ship and Port Security (SOLAS/ISPS) and Waste Management (EU) and Vessel Monitoring (EU) which require compliance. The increased need for reporting and exchange of information will be increasingly achieved by the use of EDI messages; at the same time, there is a need to reduce the differences between the information exchange formats used by individual stakeholders and for harmonisation of the reporting requirements.

There are several standards organizations and groups active in the maritime sector which have, as one of their objectives, the aim of standardising data and message formats to ease the transfer of information between the stakeholders in their particular sector. Some of these maritime groups, such as the SMDG, ITIGG and their activities are described in Section 6.EDIFACT has been adopted widely in sea transport in the past and much effort is now being expended in standardizing on XML, specifically adapted initially for the transport sector (TransportXML), and now also being applied to the maritime sector (ShortseaXML), as the preferred messaging format. Currently short sea shipping stakeholders communicate using standard EDIFACT messaging, or

proprietary messaging or a combination of both[4]. EDIFACT is not actively being developed; it can be costly to implement thus discouraging smaller stakeholders from adopting the format[5].

7.3.2 Interoperability

In future, information systems such as those described in previous sections will be required to operate efficiently together; in the case of D2D transport networks, these will include road and rail related information systems. An important aspect of information flow between computers and stakeholders is the actual interfaces, message formats and information exchange protocols utilized. Different standards exist and there is a need to standardize.

Interoperability will be a crucial capability; this can be defined as the ability of different types of organisations to interact together for their mutual benefit in the sharing of information and knowledge by means of exchanging data between their respective ICT systems. In order to achieve this, it is necessary for diverse types of organisations to have an agreed framework covering aspects such as *semantics (*meaning of information elements and the relationship between them, vocabularies etc) to ensure that the information is understood in the same way by different organizations or stakeholders. It is essential that new information systems have the capability to operate with the legacy systems which will be retained by many stakeholders.

7.3.3 Service Oriented Architecture

Many current information systems employ an architecture comprising distributed processing in conjunction with a suitable interconnecting network; the associated software architecture comprises essentially of individual software packages in each of the distributed processors (carrying out specific functions) with over-riding management software to control the whole system. This architecture is a significant step forward compared to the use of a single central processor in terms of flexibility, graceful degradation and redundancy; additional processors can be added for additional functions at later stages as required. However, there are still limitations caused by the rigid

[4] Christophe Reynaud of Marseille Gyptis International http://www.gyptis.fr told the final ShortSeaXML conference that they support a combination of proprietary native XML and EDIFACT, with the native XML posing the most problems

[5] UN/EDIFACT Version 4 Release 1 2002 - http://www.gefeg.com/jswg/v41/data/v4_v41_diff.htm

hardware design which will restrict the growth of future information systems and their management.

Information systems used in maritime, road and rail systems will need to communicate with each other on a more flexible basis both in terms of an increased and changing number of information systems which need to communicate together and the different levels of technology and software employed. While future information systems may still be distributed in nature, utilise updated legacy systems, there will also be a new generation of systems emerging utilising the latest enabling technologies.

An approach which is being proposed and is being developed in some business sectors which will overcome the limitations of current systems is the use of service oriented architectures (SOAs). A service oriented architecture should make it much easier for systems to communicate with each other and make system reconfiguration easier in line with changing business requirements and the information to be exchanged.

The basis of SOAs is that services are used as the modular building blocks in information systems as opposed to hardware blocks enabling existing or new services to be added or removed as required. Services must therefore be easily requested or addressable on a network interface. Standard formats and protocols must be used by all parties concerned so that users can easily have access to required information. SOAs provide a means of significantly improving the interoperability of information systems and services.

According to W3C, a service-oriented architecture (SOA) specifies a set of components whose interfaces can be described, published, discovered and invoked over a network. SOA aims to promote software development in a way that leverages the construction of dynamic systems which can easily adapt to volatile environments and be easily maintained as well.
The decoupling of system constituent parts enables the re-configuration of system components according to the end-user's needs and the system's environment. Furthermore, the use of widely accepted standards and protocols that are based on XML and operate above internet standards (HTTP, SMTP, etc) enhances interoperability.

Service-oriented development emerged as an evolution of the component-based development and among its goals is to support the loose coupling of system parts in a far better way than existing component-based technologies. The ramifications of service-oriented development can be observed both at the system and the business level. Having systems composed of services offered by various service providers provides the basis for supporting new business models, such as “virtual organizations”.

Web Services Description Language (WSDL) http://www.w3.org/TR/wsdl

WSDL 1.1 is used today to describe and publish the public interfaces of Web services. WSDL is an XML format for describing network services as a set of endpoints operating on messages. The operations and messages are described abstractly, and then bound to a concrete network protocol and message format to define an endpoint. Related concrete endpoints are combined into abstract endpoints (services).

A WSDL document is simply a set of definitions. There is a definitions element at the root, and definitions inside. Services are defined using six major elements:

- *Types*, which provides data type definitions used to describe the messages exchanged.
- *Message*, which represents an abstract definition of the data being transmitted. A message consists of logical parts, each of which is associated with a definition within some type system.
- *Port type*, which is a set of abstract operations. Each operation refers to an input message and output messages.
- *Binding*, which specifies concrete protocol and data format specifications for the operations and messages defined by a particular port type.
- *Port*, which specifies an address for a binding, thus defining a single communication endpoint.
- *Service*, which is used to aggregate a set of related ports.

7.3.4 TransportXML

NorStella, which is a Norwegian non-profit private Foundation for ebusiness and trade facilitation with an objective to develop and promote the use of open, international standards for interoperability between eGovernment, eBusiness and eTrade, coordinated a project during 2001/2002, which was funded by the Norwegian Gov-

ernment, to develop an XML messaging format called transportXML[6]. This XML based standard for electronic collaboration within the transport and freight forwarding industry is now used by the transport industry in Norway through the transport portal TakeCargo. Based on international standards (ebXML as developed by UN/CEFACT), it is expected to be a global standard for all kind of transport and freight forwarding in the future.

The responsibility for further development and maintenance of transportXML was handed over to the Forum for Elektronisk Samhandling innen Transport in 2003 and to date there have been several updates approved for use. One of the main tasks of the forum is the maintenance of transportXML, including the approval and documentation of new versions and assisting transportXML implementations.Project: Transport XML

Websites:
www.takecargo.no
www.norstella.no

7.3.5 ShortSeaXML

The Shortsea XML project was financed by the European Commission through its "Marco Polo Common Learning" funding scheme and ran between 2006 and September 2008. The project was coordinated by Norstella, which was given the role as a lead partner for developing transportXML to cover the short sea-industry and hence into a European standard for intermodal transport. Based on international standards it will comply with UN/EDIFACT, ebXML and transportXML.

The aim of the ShortSeaXML project was to improve the competitiveness of Short Sea Shipping (SSS) by reducing administrative costs. It is estimated that 20-30% of the cost of a shipment is spent on administration. With the introduction of the ShortSeaXML messaging formats into the existing business processes, the project implementers Hans Kristian Haram and Mariann Sundvor suggest that 10% of costs will be saved over 5 years.

[6] TransportXML portal is TakeCargo - www.takecargo.no

The core objective of Shortsea XML is to introduce a common messaging standard which has the potential of reducing overall costs by 10-20% thereby increasing the competitiveness of shortsea shipping when compared to road; it is hoped that by achieving this cost reduction more freight will be encouraged to shift from road to sea. It is expected to be a global standard for all kind of transport and freight forwarding in the future. The Shortsea XML project supports a network of shippers, carriers, ports, intermediaries and IT providers who are working together to develop the new standard.

Shortsea XML is a message standard designed to streamline the administration processes within a short-sea based logistics chain. The standardized messages – based on XML technology – comprise the core processes of scheduling, booking, operations and status. Implementing these new standards within a supply chain will help to reduce costs, cut administration, streamline process and, ultimately, improve the competitiveness of short-sea transport.

Shortsea XML is built on Transport XML to ensure compatibility with other transport modes. The core elements will be the same with some specific fields to meet short sea requirements and is a message standard that makes transfer of information between all parties in the transport chain as well as to authorities more efficient and hence contribute to shift of transport to sea.

It is expected to be a global standard for all kind of transport and freight forwarding in the future. The Shortsea XML project supports a network of shippers, carriers, ports, intermediaries and IT providers who are working together to develop the new standard. Shortsea XML will become the open message standard for exchanging data between all parties in a door-to-door short sea logistics chain. This will deliver enhanced flexibility and ease of use for all parties (irrespective of size) in the door-to-door transport chain. ShortseaXML caters for aspects such as Scheduling (Master, voyage, port of call), Booking (container, Roro, D2D consignment, D2D equipment, cars), Manifest (Cargo, Loading/Discharge,), Status (Track and Trace, Arrival) The ShortseaXML standard is promoted by the European Short Sea Network and the individual Shortsea Promotion Centres.

The ShortseaXML project has produced the following:

Results:

1. ShortSeaXML has developed standard XML messages for scheduling, booking, manifest, status updates
2. Software service providers such as SoftShip have developed a software solution that uses ShortSeaXML as the messaging format[7].
3. The messages for booking a consignment or booking a space for one or more consignments is being piloted with EWALS and Norfolk Line, specifically the defining of a RoRo subset of messages.[8]
4. The results of the ShortSeaXML project were presented at UN/CEFACT conference in Geneva on 16th September 2008.
5. ShortSeaXML messages can be quite large, 600 nodes in some cases. A business can reduce the amount of information required by using the parts of the message applicable to their purposes. This is called a subset of the ShortSeaXML message.
6. ShortSeaXML subsets can be modified for particular business if the information they require is not already defined. As long as the message format follows the hierarchical structure and schema them the messages are allowed.
   For example, an importer in the car trade business may want to track information particular to his business, such as car <make/> and <model/>. This information can be added by means of an implementation specific subset in the ShortSeaSML message. This flexibility does not contravene the standard approach to messaging, allows diverse business uses to enter into the ShortSeaXML community, and provides a framework for the continued adoption and development of ShortSeaXML. Each subset can be made available to the community of ShortSeaXML users, thus allowing other car importer businesses to utilise the schema without delay.

[7] SoftShip – www.softship.com – implemented the interface for the cargo manifest "inbound cargo to Amsterdam from Norway".
[8] Draft booking RoRo subset - http://www.shortseaxml.org/Detail.aspx?PageName=BookingRoRoSubset

7. ShortSeaXML messages are not designed to replace EDIFACT formats but to work in tandem with EDIFACT. A mapping from one message format to the other has been defined.
8. This mapping process can also be developed for other proprietary messaging formats that might exist, such as SafeSeaNet HAZMAT messages.

Benefits

1. The ebXML UN/CEFACT standards are not likely to be superseded as the international vested interest extends beyond the SSS community into many other business processes.
2. The ShortSeaXML project has not only identified the messages for scheduling, booking, manifest and status of cargo in the D2D short sea logistics chain, but defined a process to make it applicable and flexible for a number of diverse businesses though the use of subsets, and designed for its continued development though the community user group model.

Limitations:

1. The limitations of the metrics:
    a. Not all 60+ cases that the ShortSeaXML project engaged with returned useful metrics about their projected cost savings. Some of the metrics will have to be gathered in September before the final project report is submitted, which is not ideal.
    b. A year on year cost saving of 10% is rather ambitious given that software implementation costs will also be incurred, which was not overly stressed in the presentations.
    c. Though the ShortSeaXML messages are defined, business specific investigation, integration and implementation will be required. The ShortSeaXML user community should be able to address this so as to define the implementation process and minimise its cost.
2. The ShortSeaXML project primarily focused on the commercial benefits to SSS, thus no XML has not been defined for processes such as port authority reporting, coast administration reporting, or customs reporting. It would have been a useful exercise for the ShortSeaXML project to define in general terms the SSS processes that could potentially benefit from ShortSeaXML before

continuing with the necessary tasks of defining, implementing and promoting the most common and useful processes.

There are a number of related projects and it would be good to see early adoption of similar standards based process to messages pertaining to other specific research areas.

3. Port authorities have invested in EDIFACT systems which they will be hesitant to supersede with any other parallel formats such as ShortSeaXML

Future:

The future developments on this project are quite positive; a user group has been formed on 17th November 2008 in Schifhol, Amsterdam. The community of ShortSeaXML users will be invited to contribute. The modules that are not yet complete – scheduling, manifest and status updates – will be prioritised. They hope to define a compliance process for new ShortSeaXML messages.

As mentioned at the ShortSeaXML final conference on 15th September 2008, the largest challenge to the adoption and use of ShortSeaXML is 'management buy-in' from the stakeholder businesses. Two of the presenters at the conference, EWALS and Gyptis, had already researched and achieved management's strategic agreement on the benefits of a standard messaging approach to SSS communications and were actively looking for a partner in this area when they came across the ShortSeaXML project in 2007.

Freightwise has recognised the complexity in information exchange resulting from these approaches and suggests a set of fewer and strictly standardised information objects.

The project will follow and review the outputs from the above two projects to indentify re- usable results and to suggest ways of taking things forward.

Projects:

Shortsea XML
Freightwise

IATA e-freight

Websites:
www.shortseaxml.org
www.shortsea.info
http://freightwise.info/cms/

7.3.6 GSI Logistics Interoperability Model (LIM)

Overview

GSI is a non-profit making global organisation which is dedicated to the design and implementation of global standards, technologies and solutions to improve the efficiency and visibility of supply and demand chains for use across several diverse sectors such as consumer electronics, defence, healthcare, retail, transport and logistics. The role of GS1 is that of enabler and facilitator in the generation of global standards which it develops on behalf of its member organisations; it operates in over 100 countries and across 20 diverse industries.

GS1 liases with official bodies such as the United Nations, the European Commission, institutions and international organisations during the development of its standards. GSI also works alongside customs authorities and the use of the GS1 standards creates the possibility of using a single window where the submission of one set of information can be easily accessed by authorized stakeholders. This latter aspect is particular relevant to several maritime services which are addressing the application of the single window approach.

The Organisation offers a diversified portfolio of products, solutions and services, including the GS1 System of Standards, the most widely used supply chain standards system in the world. The Organisation's main activity is the development of this GS1 System which comprises a series of standards designed to improve transport and supply chain management. GS1 standards help clearly identify things (such as items, locations, and logistics units and assets) and connect these to related information.

GS1 System of Standards

Overview

In order to achieve interoperability between the different business systems and processes employed by the various stakeholders in maritime based D2D logistics chains, it is necessary to understand how the different business processes work, how they can be interconnected and to develop standards which support the efficient exchange of information and messages between stakeholders. In addition, the use of emerging technologies such as global satellite positioning systems and RFID (radio frequency identification) tagging are seen as enablers in ensuring that goods being transported from D2D are identifiable and locatable at all times wherever they are in the supply chain. Such information has to be available to all stakeholders who have a need to know.

The GS1 System of Standards[9] offers this possibility because it is an integrated system of global standards that provides for accurate identification and communication of information regarding products, assets, services and locations. It is the most implemented supply chain standards system in the world and is the foundation of a wide range of efficiency-building supply chain applications and solutions.

The GS1 System is based around a set of Identifiers which can be put on bar codes, RFID tags etc. These main ones are:

Global Trade Number (GTN) – uniquely identifies a company and trade item
Global Location Number (GLN) –-identifies a location or position in warehouse
Serial Shipping Container Code - identifies an individual logistics unit (container/pallet)

Examples of others are Global Individual Asset Identification (GIAI), Global Document Type Identifier (GDTI), Global Identification Number for Consignment (GINC), Global Shipment Identification Number (GSID),

The standards portfolio ranges from the use of common identifiers, bar codes, electronic commerce tools, business message standards (e.g. XML), data synchronization, RFID technologies and traceability. These four key product areas are described in more detail in the following sections.

[9] The Value and Benefits of the GS1 System of Standards downloadable from http://www.gs1.org/sites/default/files/docs/GS1_System_of_Standards.pdf

***Bar Codes Standards*:** GS1 has been managing barcode standards for the identification of products, places and pallets for over 30 years and has recently developed standards for the DataBar, a smaller version of the previous bar code system which contains more product information. The increasing need for product traceability in the logistics chain has resulted in bar codes becoming an essential element in track/trace systems for use with a wide variety of scanners.

***EPCGlobal Standards*:** Radio Frequency Identification (RFID) is being increasingly used for the identification of products, containers etc. This type of system involves the use of various components such as RFID tags, Tag Readers, Hand Held Tag Readers etc. When combined with a communication infrastructure, this type of technology enables the immediate and automatic identification and location of an item which means it can be tracked throughout the whole supply chain thus providing improved efficiency and visibility through the supply chain. GS1 has developed global standards which cover the combined RFID/communication network.

GS1 eCOM Standards – these are global standards for electronic business information exchange which provide guidelines on generating all kinds of electronic documents and on electronic business messaging. These standards, which enable the efficient and rapid automatic and accurate transfer of messages, are based on two GS1 Components, EANCOM and GS1 XML.

EANCOM is based on UN/EDIFACT and covers all the functions required for a complete trade transaction from selecting and ordering goods to delivery to customer including payment. Messages available in EANCOM include master data messages (contact details etc), business transaction messages, report and planning messages, syntax and service report messages and security messages (digital signatures etc).

GS1 XML is fully compliant with UN/CEFACT. It provides a standardised and predictable structure for electronic business messages, enabling business partners to communicate business data rapidly, efficiently and accurately, irrespective of their internal hardware or software types GS1 was one of the first standards organisations to

publish a global XML-based business standard, and the GS1 XML currently contains more than 60 “document” XML messages, not counting supporting messages from the common library.

Global Data Standards Network (GDSN): These set of standards enable all the stakeholders in a supply chain to synchronise information that is held in their databases so that updating occurs simultaneously. In this way when a set of information is updated by one stakeholder, all other stakeholder that hold the same information are updated at the same time. This ensures that business partners always have the latest information in their systems, and any changes made to one company’s database are automatically and immediately provided to all of the other companies who do business with them.

Logistics Interoperability Model

GS1 are also developing a Logistics Interoperability Model[10] (LIM), the objective of which is to gain benefits for global supply chains by increasing the business interoperability and visibility of operations. It is anticipated that the LIM will provide a framework for common business processes, common communication and identification solutions which will overcome the problems of interoperability, lead to more transparency, improved visibility of the flow of goods and a reduction in the overall cost through the supply chain. The model will incorporate all the relevant current GS1 standards.

The LIM is particularly targeted at ensuring interoperability in the transport/warehouse business processes and aims to achieve this by harmonizing the interpretation of the business processes, as well as standardising the structure and content of the data interchanges. The Model will cover the following functions: procurement, planning, warehousing, transport and financial settlement.

The initial Model will cover continental transport modes which include road/rail/inland waterways/shortsea modes and as such it will be of direct relevance to

[10] Logistics Interoperability Model, Version 1, Issue 1.0, August 2007 downloadable from http://www.gs1.org/transportlogistics/forum/work_groups/lim/

maritime based D2D transportation. The intention is to include air and sea transport at a later date.

8. Review of Standardisation Initiatives

8.1 Overview

Efficient and accurate interoperability between stakeholders requires specifications and standards so that stakeholders which need to communicate with each other have a guaranteed level of compatibility. New standards and regulations need to be put in place and/or existing standards improved which govern information gathering, storage and exchange between stakeholders. Currently there are national and international standards co-existing which cover similar aspects and sometimes overlap and have inconsistencies between them because of the timescales and ways in which they have been developed.

A study carried out within the MarNIS[2] project concluded that 'harmonisation, standardisation and simplification of processes, procedures and information exchanges between maritime authorities and ships (agent / master) is functionally and technically feasible: although data are included in different documents with different format and are interchanged in a different way in each European port.
Several organizations and standard bodies are now working towards achieving efficient, error free information flow between the various stakeholders in a D2D transport chain by ensuring that there are adequate standards in place... These organizations, as discussed in the following sections, include the United Nations Centre for Trade Facilitation and Electronic Business, (UN/CEFACT), the International Organization for Standardisaton (ISO) and the International Maritime Organisation (IMO)., the SMDG and ITIGG.

The MarNIS project has issued an overview of a number of existing standards and recommendations related to information flow in the maritime and D2D industries[11]. This lists the organizations involved in setting and maintaining the relevant standards

[11] Interim Report on Standards, MarNIS Deliverable Ref. No. D-HA3C, 16th May 2006

and their roles. The SKEMA project has carried out a periodic study[12] into the standards requirements and strategies required to implement the e-maritime concept being promoted by the EU; many of these are relevant to the information management and exchange in D2D transport networks.

Websites: www.marnis.org

www.skematransport.eu

8.2 UN/CEFACT

The United Nations, through its Centre for Trade Facilitation and Electronic Business (UN/CEFACT) supports the facilitation of national and international transactions, through the simplification and harmonisation of processes, procedures and information flows, and so contributes to the growth of global commerce. UN/CEFACT, in developing standards, cooperates with the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU) and selected non-governmental organizations (NGOs).

UN/CEFACT controls the work of maintenance and further development of the UN/EDIFACT international standard which is an EDI standard developed under the United Nations. EDIFACT has been adopted by the International Organisation for Standardisation as the ISO Standard ISO 9735.

Website: www.unece.org/cefact/

8.3 OASIS

OASIS (Organization for the Advancement of Structured Information Standards) is a not-for-profit, global consortium that drives the development, convergence and adoption of e-business standards. OASIS produces worldwide standards for security, Web services, XML conformance, business transactions, electronic publishing, topic maps and interoperability within and between marketplaces. OASIS and the United Nations jointly sponsor ebXML a global framework for e-business data exchange. OASIS op-

[12] Skema Study Report: e-Maritime Standardisation Requirements and Strategies, 12 10 2009

erates XML a community clearinghouse for XML application schemas, vocabularies and related documents. OASIS hosts COVER Pages, an online reference collection for interoperable mark-up language standards.

Website: www.oasis-open.org/

www.ebxml.org

www.xml.org

http://coverpages.org

8.4 International Standards Organisation (ISO)

The International Organisation for Standardisation (ISO) is a non-governmental organisation which promotes the development of standardisation activities worldwide. ISO standards are available for facilitating the international exchange of goods and services, and to developing co-operation in the spheres of intellectual, scientific, technological and economic activity.

The Organisation has adopted EDI standards developed by UN/CEFACT for example:

ISO 15000-1: ebXML Collaborative Partner Profile Agreement

ISO 15000-2:, ebXML Messaging Service Specification

ISO 15000-3: ebXML Registry Information Model

ISO 15000-4: ebXML Registry Services Specification

ISO 15000-5: ebXML Core Components Technical Specification, Version 2.01.

The ISO standard ISO/PAS 28005-2:2009 contains technical specifications that facilitate efficient exchange of electronic information between ships and shore for coastal transit or port calls. It is intended to cover safety and security information requirements related mainly to the relationships between the ship and the port and coastal state authorities as defined below.

This standard contains the definition of core data elements for use in electronic port clearance (EPC) messages. It contains definitions of core data elements for electronic messaging between ships and shore in the areas of safety, security and marine operations. It does not define any structuring of messages or provide any guidance on what information is required for a particular purpose; it is rather a general data dictionary for safety, security or operation-related maritime information. It is intended for use in XML messages and will for that reason differ somewhat from the similar trade data elements directory (TDED) International Standard (ISO 7372).

The core data elements defined in ISO/PAS 28005-2:2009 are specified so that their meaning and interpretation in general shall be independent of the context they are used in. This Standard does not define the message formats required to exchange information.

ISO/PAS 28005-2:2009 contains definitions of core data elements for electronic port clearance. These elements cover all requirements for ship-to-shore and shore-to-ship reporting as defined in the following.

1. All FAL standard declarations (FAL 1 to 7) as defined in the FAL Convention.
2. ISPS reporting requirements as defined in ISPS and MSC 1130.
3. All general ship reporting requirements as defined in IMO A.851]
4. Recommended reporting on ship generated waste as defined in MEPC 644 (mandatory within the European Union, as described in EU/2000/59).
5. Required reporting as defined in the bulk loading and unloading code IMO A.862.
6. ETA reporting to pilot station as defined in IMO A.960.

ISO/PAS 28005-2:2009 can also be used for information exchanges between the ship and the ship agent, the port as well as ship operator or manager. It will not necessarily cover issues such as customs clearance of imported or exported goods or transport service provisions to goods owners.
Website http://www.iso.org/iso/catalogue_detail.htm?csnumber=54501

8.5 International Maritime Organisation (IMO)

Within the IMO important steps have been taken to diminish the administrative burden of all sorts of documents that have to be filled in and transferred to the different authorities in each different country. The Convention on Facilitation of International Maritime Traffic (FAL Convention) includes in its Standard 2.1 a list of documents which public authorities can demand of a ship and recommends the maximum information and number of copies which should be required.
IMO has developed Standardized Forms for these documents, which are also available in electronic format. The same information will need to be transferred electronically as is required in paper format; however, electronic documentation provides a further means of rationalisation and increased efficiencies.

The IMO has issued a Compendium on Facilitation and Electronic Business which contains simple message descriptions, the data and codes used for all FAL forms and other relevant messages for the exchange of information between port administration, port authorities and ship/agents/shipowners. The aim of the FAL Compendium, to be issued as FAL.5/Circ. 14, is to contribute in facilitation maritime traffic and to prevent unnecessary delays. The work done by the IMO facilitation committee (IMO FAL) and by UN/ECE on development of these standardised electronic and paper documents has done much to improve the reporting documentation especially in ports.

The IMO consider that it would be appropriate to standardize the format for ship reporting systems and agreed, in principle, with the proposed Extensible Markup Language (XML) format standards for maritime services. It was felt that direct data exchange between ship to shore, but also between vessel traffic services (VTS) and others (authorities, shipowners and shipping agencies), by XML format, would contribute to improved safety and security.

For example, XML is to be used for LRIT data reporting and suitable schemas have been defined by the IMO (see DDP-GN-01, LRIT DATA DISTRIBUTION PLAN, ACCESSING AND ENTERING INFORMATION, GUIDANCE NOTES FOR CONTRACTING GOVERNMENTS, Annex 3 and Annex 4). Similarly, it is proposed that the data form Synthetic Aperture Radars (SAR), AIS and combined SAR/AIS da-

ta when used for ship detection and pollution monitoring should be exchanged in the XML format.

The IMO has also recommended the establishment of an XML-based Single Window System framework in an effort to simplify, standardize and make effective use of present arrival and departure information through electronic means. A Single Window environment is defined as an intelligent facility which allows the stakeholders involved in trade and transport to lodge standardized information, mainly electronic, with a single entry point to fulfill all import, export and transit related regulatory requirements.

Website: www.imo.org

8.6 Shipplanning Message Development Group (SMDG)

SMDG, which is a non-profit foundation run by and on behalf of companies and organisations working in the maritime industry (such as container terminals, ocean carriers and related companies and organisations), develops and promotes UN/EDIFACT EDI messages for the Maritime Industry and is an official Pan European User Group, recognised by the UN/EDIFACT Board. The original objective of the group was to agree a standard format for the exchange of ship stowage planning information which defines the position of containers in a vessel. This message was known as the BAPLIE message (Bay Plan Stowage Plan Occupied and Empty Locations message. Most carriers and deep-sea container terminals are now dependent on its use for accurate and timely information.

SMDG was involved in the ShortSea XML project as a member of the Advisory Board representing the interests of Shipping Lines and Container Terminals and also in maintaining and promoting standards and deliverables after the completion of the project.

Website: www.smdg.org

8.7 International Transport Implementation Guidelines Group (ITIGG)

ITIGG, which is an international group of experts engaged in the development and implementation of UN/EDIFACT standard messages for electronic trading in the transport industry, was established in 1995. ITIGG is a sub-group of TBG3 (which covers the interests of all modes of transport) the UN/EDIFACT Message Development Group for Transport. ITIGG develops recommendations which provide software developers with a series of simple, straightforward tools to assist in designing applications which can be used for trading electronically throughout the world, and to clarify the intentions of the designers of key UN/EDIFACT messages.

ITIGG has compiled and issued documents which provide the principles and rules for the international implementation of electronic messages in the transport industry together with harmonised guidelines for all modes of transport (maritime, air, road, rail and other means of inland transport). ITIGG is actively participating in the UN/CEFACT process of comparing and harmonising segment usage between different industry sectors

Website: http://www.smdg.org/itigg/

8.8 PROTECT

When vessels enter or leave ports, they have to comply with the reporting requirements of the port authorities such as the formal and legal notifications required and also the requests for services from the port and vessel handling companies. Vessels also need to exchange information with their owners, operators, agents, freight forwarders etc. The PROTECT Group, which includes several port authorities (Antwerp, Bremen, Felixstowe, Hamburg, Le Havre, London, Rotterdam, Amsterdam) and the National Competent Authority of Spain, has developed and established harmonised world-wide recognised EDI message standards for ship reporting. This EDI standard, called the PROTECT Guide (version 2.0, March 2005) describes in detail the messages exchanged between shipping lines and/or their agents or forwarders to and from the Port Authorities or National Competent Authorities.

The PROTECT Guide has gained recognition from the IMO and ITIGG:

> The IMO/FAL (Trade Facilitation Committee of the International Maritime Association) has recommended the PROTECT IFTDN message (see definition below) as the EDI equivalent of the IMO FAL Form 7 (Dangerous Goods Declaration). This message can also be used for Dangerous Goods List or Manifest to be known as FAL Form 8.
>
> The PROTECT Guide is also endorsed by the UN/EDIFACT standardisation bodies TBG3 and ITIGG

The latest version of the GUIDE takes into account latest IMO and EU legislation and defines new message formats for:

> **BERMAN** - The Berth management message is a message from a carrier, its agent or means of transport to the authority responsible for port and waterway management, requesting a berth, giving details of the call, vessel, berth requirements and expected operations
>
> **WASDIS** – Waste disposal information message which conveys information on last inspection and/or on waste and cargo residues on board of a means of transport (e.g. vessel) and/or equipment related to a means of transport - and still to be disposed in the next place or port of call of the means of transport. The message supports the implementation (by means of EDI) of the notification requirements as laid down in the Waste directive 2000/59/EC which covers port reception facities for ship-generated waste, cargo residues and sewage
>
> **IFTDGN** - The International Forwarding and Transport Dangerous Goods Notification message is a message from the party responsible to declare the dangerous goods (e.g. carrier's agent, freight forwarder) to the party acting on behalf of the local authority performing the checks on conformance with the legal requirements on the control of dangerous goods, normally Port Authority, conveying the information relating to one conveyance/voyage of a means of transport such as a vessel, train, truck or barge, on the dangerous goods being loaded, unloaded, and/or in transit. which covers vessel monitoring, port handling of danferous goods and polluting and noxious substances.

APERAK - Application error and acknowledgement message. The function of this message is: a) to inform a message issuer that his message has been received by the addressee's application and has been rejected due to errors encountered during its processing in the application and/or to acknowledge to a message issuer the receipt of his message by the addressee's application

Website: www.smdg.org7.Overall Conclusions and Recommendations

This study report provides an overview of electronic messaging, the formats and standards which have been developed in the field of business-to business information and the relevance of these in the maritime and transport sectors. The development of electronic messaging standards for specific application in the freight transport and short sea networks is described, the likely future trends are discussed and the initiatives adopted by the standardisation bodies and IMO reviewed. Conclusions have been drawn and recommendations made.

The increasing need-for and the increasing amount-of information available to stakeholders in the maritime transport sector is resulting in a multitude of information systems being developed by clusters of stakeholders. These tend to be autonomous and are not always capable of communicating with each other and hence the efficiency of information transfer is limited. Interoperability is restricted.

In D2D transport chains, stakeholders need to obtain and provide information and communicate with several information systems. What is needed for the future is much better and efficient cooperation between all Stakeholders in the D2D supply chain and the provision of improved information management and services, improved transparency, especially at the intermodal interfaces together with the use of EDI and electronic processes throughout the intermodal supply chain.

In support of this, new standards and regulations need to be put in place and/or existing Standards improved which govern information gathering, storage and exchange between stakeholders. Currently there are national and international standards co-existing which cover similar aspects and sometimes overlap and have inconsistencies between them because of the timescales and ways in which they have been developed.

While standards are seen as the traditional route to achieving improved interoperability, the drawback is that international standards take considerable time to be developed. The primary aim should be to put in place international standards covering processes, interfacing and performance covering information management and exchange. In the shorter term, European standards should be developed to cover European D2D transport networks. Such standards should be developed in close proximity with other transport modes involved in D2D to facilitate multimodal transport. A common information sharing and exchange environment with common information exchange standards is required. This may well require the need for distributed processing technology, as opposed to a centralized approach, with inbuilt redundancy to ensure that partial failures, loss of subsystems or single window does not seriously degrade information availability or flow. SafeSeaNet, which is being promoted by the European Community, should be used by all relevant user communities and be developed further to function as the main platform for information exchange in the EU maritime domain with regard to port arrival and departure notifications, notifications on dangerous goods, maritime security notifications, incident and accident information, AIS, LRIT and pollution monitoring[13].

Standards organizations such as the IMO, WCO, UN/ECE, ISO, IEC should be encouraged to coordinate their efforts to ensure a common approach is adopted across the transport/business sectors in terms of e-commerce and reporting of activities to authorized organizations. Public authorities and organizations should ensure that they communicate and coordinate their activities in relation to the harmonisation and standardization of information requirements and message formatting. The maintenance and updating of EDI standards should be ensured through the relevant organizations; where these do not exist or are not formalized, suitable Working Groups (such as the ITIGG and SMDG) should be encouraged which involve all D2D stakeholders.

Forrester Research published a study in 2007 titled “B2B Integration Trends: Message Formats” in which they estimated that 85-90% of all B2B transaction volumes are based upon EDI. The newer, more powerful XML standards are growing quickly but are estimated at about 15% of transaction volumes although it is anticipated that most

[13] **e-navigation, e-maritime: Do these initiatives lead to e-frustration among Harbour Masters,** Capt. Andreas Mai Harbour Master, Ports of Bremerhaven & Bremen7th IHMA Congress – Global Port & Marine Operations, 19 – 23 April 2010, Sheraton Perth, Australia

large companies will standardise on XML for new projects. As a result, the study suggests that its use will gradually increase and will eventually reach up to 40% to 50% of transactions.

EDIFACT has been adopted widely in sea transport in the past and Port Authorities have invested in EDIFACT systems which they will be hesitant to supersede with any other parallel formats such as XML. However, much effort is now being expended in standardizing on XML, specifically adapted initially for the transport sector. TransportXML has been adopted for freight transportation and is in use in Norway.

A version of TransportXML is being developed and is now being applied to the maritime sector. Known as ShortseaXML, it is being proposed as the preferred messaging format. This is being supported by EU initiatives such as SSN and e-Maritime. The ShortSeaXML project has not only identified the messages for scheduling, booking, manifest and status of cargo in the D2D short sea logistics chain, but has defined a process to make it applicable and flexible for a number of diverse businesses through the use of subsets, and designed for its continued development though the community user group model. It is scheduled to become the standard for D2D intermodal transport in the future.

The ShortSeaXML project, however, primarily focused on the commercial benefits to SSS, thus no XML has been defined for processes such as port authority reporting, coast administration reporting, or customs reporting within the project. It would have been a useful exercise for the ShortSeaXML project to define in general terms the SSS processes that could potentially benefit from ShortSeaXML before continuing with the necessary tasks of defining, implementing and promoting the most common and useful processes.

A set of standards covering logistic supply chains has been developed by GS1, a leading non-profit making global organisation dedicated to the design and implementation of global standards, technologies and solutions to improve the efficiency and visibility of supply and demand chains for use across several diverse sectors including transport and logistics. These standards apply to many business sectors. The standards cover all

aspects of business processes such as information exchange formats, identification and tracking of cargo etc and apply to the use of the latest enabling technologies in bar codes, RFID etc. The benefits of using the GS1 Standards can include improved efficiency, increased visibility of the flow of goods and shipments, more efficient handling and inventory management, increased security of distribution and speed of operations. The GS1 system of standards and in particular the Logistics Interoperability Model, which is under development, and which includes waterborne and short sea transport warrants investigation in terms of the applicability to maritime based D2D logistic chains.

The EU Initiatives put in place to ensure the future of maritime transport, such as e-Freight, e-Customs, e-Navigation and in particular, the over-riding e-Maritime Initiative, will facilitate the change to the use of ICT, and integrated electronic information management and exchange that is required to ensure the future of European and international D2D transport networks. Both the EU's e-Navigation and e-Maritime Initiatives and the IMO promote the concept of a single window approach for common reporting and ease of access to information in order to reduce the manual paperwork which reduces potential errors.

The move to overall information management, integrated information systems and electronic information exchange will bring with it the need for investment by all stakeholders involved in the D2D chain in terms of enabling technologies, updating of legacy systems; an equally important requirement will be investment in suitable training courses which will be required to ensure the efficient use of the new systems and the processing and handling of electronic information.